Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Heterogeneous confinement in lateral quantum dot molecules
JIE PENG, GABRIEL BESTER, Max Planck Institut for Solid State Research, Stuttgart — We show that by the combination of an atomistic many-body approach, knowledge of the detailed morphology of the QDMs, and PL experiments, we reach a thorough understanding of the underlying processes involved in the optical experiment. We highlight the importance of electronic coupling in lateral dot molecules fostered by the presence of an In-poor basin connecting the dots from below. This leads to a peculiar confinement situation with regions of type I band alignment close to a coupling region on the verge to type II. Beyond the static picture we find strong evidence, backed up by PL measurements, for a dynamical model ensuing from the lack of potential barrier felt by the electron in opposition to the decoupled holes. This model leads to a qualitatively different behavior for absorption and emission processes under non-resonant excitation and represent an interesting type of nano-laboratory. Having the ability to manipulate the position of the significantly coupled electrons within the QDM leaves it not only as a wavelength tunable single-photon source but also as a potential building block for quantum gates based on single charges and spins. In order to achieve this, regimes of coherent coupling within the QDM have to be investigated, such as the resonant tunneling of an electron.

Gabriel Bester
Max Planck Institut for Solid State Research, Stuttgart

Date submitted: 20 Nov 2009 Electronic form version 1.4